REMARKS

Reconsideration and allowance of this application, as amended, is respectfully requested.

This Amendment is in response to the Office Action dated May 28, 2004. Appreciation is expressed for the indication of allowable subject matter in claims 4-6. By the present Amendment, each of claims 4-6 has been rewritten into independent form to place it in condition for allowance. Therefore, entry of this Amendment, and allowance of claims 4-6, is respectfully requested.

Briefly, the present invention is directed to an improved arrangement for accurately detecting misfires in a multi-cylinder internal-combustion engine, particularly in situations where misfire can be judged erroneously due to other effects such as a vehicle running over a rough road or jolting.

In particular, the present invention utilizes an arrangement having two filters and a judgment means operating in conjunction with a revolution detection means that measures the time period required for the crankshaft to revolve through a given angle. The overall system regarding this can be seen in Fig. 1A, with the revolution detection means 1 and the signal processing means 2. Fig. 3 shows one example of such a processing means with two filters, 21 and 22 and a judgment means 23.

In accordance with one feature of the present invention (as defined in claim 1, for example), the two filters have the same sensitivity to a frequency resulting from misfiring, but differ in the sensitivity to frequencies adjacent to the frequency resulting from a misfire. These two filters operating in conjunction with a judgment means that determines that a misfire has occurred when a ratio or difference between the output of the two filters stays within a fixed range and one or both of the

two filters have respective outputs exceeding a threshold value. An example of this can be seen, for example, in Fig. 4, with the respective filter outputs for the filters 21 and 22 being shown with the letters (A) and (B).

Claim 2 defines further features of the present invention, again including two filters and a judgment means. In this particular arrangement, the first filter has a zero sensitivity to frequency components resulting from misfiring, but a frequency other than zero with regard to frequencies adjacent to the misfiring frequency. The second filter, on the other hand, has a maximum sensitivity to frequency components resulting from misfiring. The judgment means then determines that a misfire has occurred when the output of the first filter stays within a fixed range but the output of the second filter exceeds a threshold. The results of such an arrangement of filters and judgment means can be appreciated from Fig. 10 of the present application, for example. Again, Applicants have found this to be extremely effective in judging misfiring, without erroneously determining misfiring under other conditions.

Reconsideration and removal of the rejection of independent claim 1 as being anticipated under 35 U.S.C. § 102(b) by Wu (USP 6006155) is respectfully requested. In the Office Action, it is stated that column 9, lines 50-65 and column 11, lines 3-49 provide a teaching of the claimed two filters having the same sensitivity to a frequency resulting from misfiring but different sensitivity to frequencies adjacent to the misfiring frequency, and a judgment means to judge a misfire based upon the ratio or difference or outputs and the exceeding of a threshold value. Although the present invention in Wu share a common goal of using a combination of filters for resonance removal, it is respectfully submitted that

the specific claimed filters and the judgment means defined in the independent claim 1 are quire different than the arrangement in Wu.

For example, with regard to column 9, lines 50-65 of Wu cited in the Office Action, it is noted that this teaches:

> "Preferably, a combination of filters such a FIR filters, mean filters and comb filters is used to effectively remove the undesired noise and efficiently realizes the equivalent band pass firing processing."

It is respectfully submitted that this is a general teaching regarding the possibility of using multiple filters, and provides no specific teachings whatsoever of providing two filters have the same sensitivity to a frequency resulting from misfiring and differing in sensitivity to frequencies adjacent to that frequency.

With regard to column 11, lines 3-49, it is respectfully submitted that this also fails to teach or suggest the claimed filters and judgment means of claim 1. Column 11, lines 40 et seq. refers to the two filters 142 and 144 in Fig. 9 and states:

> "Preferable, the first order filters 142 and 144 are running mean estimation filters with different parameters to satisfy the requirement for the different time responses in the running mean estimation $\mu_1(n)$."

With regard to this, it is noted that the claimed two filters in claim 1 are not two first order filters, as taught by Wu. Instead, the two filters have the same sensitivity to a frequency resulting from misfiring and differ in sensitivity to frequencies adjacent to the misfire frequency, which is not at all taught or suggested by column 11, lines 3-49.

In further regard to this, it is noted that column 11, lines 27-30 of Wu teaches an output selection block 150 which is used to decide the output from the filters 142 an 144 shown in Fig. 9. However, claim 1 specifically defines a judgment means to

compare the ratio or difference between the outputs of the two filters, as well as the threshold value, in order to provide proper misfire detection. There is no suggestion of this whatsoever in the comparator block 146 taught by Wu.

Accordingly, for the reasons set forth above, reconsideration and allowance of independent claim 1 over Wu is respectfully requested. More specifically, as discussed above, Wu fails to teach or suggest the specific claimed two filters or the specific judgment means operating together with the claimed two filters.

Reconsideration and allowance of independent claim 2 over Wu is also respectfully requested. As discussed above, claim 2 pertains to use of a first filter having a zero sensitivity to frequency components resulting from misfiring but a non-zero sensitivity to frequencies adjacent to the misfiring frequency,. The second filter, on the other hand, has a maximum sensitivity to the frequency components resulting from the misfiring. In conjunction with this, the judgment means determines that a misfire has occurred "when an output of the first filter stays within a fixed range and an output of the second filter exceeds a threshold." It is again respectfully submitted that Wu completely fails to teach or suggest these claimed filters and judgment means.

Concerning this, the Office Action refers to column 9, line 66 through column 10. line 40. This portion of Wu describes a resonance removal block 82 that reduces false detection of engine misfiring. This is a shared purpose with the present invention. However, column 10, lines 27 and 28 specifically defines that the resonance removal block 82 utilizes a deconvolution method. The present invention does not use a deconvolution method, such as is the case in Wu, but instead a combination of the first and second filters having the above-noted characteristics,

operating in conjunction with the claimed judgment means. It is respectfully submitted that there is no teaching or suggestion in the deconvolution method taught by Wu of the specific first and second filters and the specific judgment means operating in conjunction with them, as defined by claim 2.

The Office Action also refers to column 12, lines 12-17 concerning the claimed filters. This portion of Wu describes the probability density functions corresponding to normal firing 156 and misfiring 158. However, this portion of Wu fails to discuss specific features of the combined filters for such misfire detection. In short, Wu fails to teach the specific types of first and second filters defined by claim 2.

Accordingly, for the reasons set forth above, reconsideration and allowance of claim 2 over the cited reference to Wu is respectfully requested.

Reconsideration and allowance of claim 3 and 7-10 over Wu is also respectfully requested. These claims contain substantially similar limitations to those discussed above for claims 1 and 2. As such, Wu also completely fails to teach or suggest these specific features set forth in the claims 3 and 7-10. Therefore, allowance of claims 3 and 7-10, together with claims 1 and 2, as well as allowed claims 4-6, is respectfully requested.

If the Examiner believes that there are any other points which may be clarified or otherwise disposed of either by telephone discussion or by personal interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

To the extent necessary, Applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of

this paper, including extension of time fees, to the Antonelli, Terry, Stout & Kraus, LLP Deposit Account No. 01-2135 (Docket No. 503.42711X00), and please credit any excess fees to such Deposit Account.

Respectfully submitted,

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